Water Shrew

Sorex palustris

DESCRIPTION

The water shrew is a relatively large shrew with soft, dark pelage. Similar to other members of its genus, it has a long tail commonly more than 40 percent of the total body length. The pointed snout, tiny eyes, concealed ears, and five toes on front and hind feet serve to identify this small mammal as a shrew. The large broad hind feed provided with stiff cilia, slightly webbed toes, and an aquatic life style separate this shrew from other congenerics in the northeast.

BODY SIZE

Water shrews are one of the largest shrews in eastern North America. Total length, tail length, and weight ranges from 138 – 164 mm, 63 – 72 mm, and 12 – 18 grams, respectively (Whitaker and Hamilton 1998). Jackson (1928) reported no difference in color, size, or proportions between males and females. Conaway (1952) and van Zyll de Jong (1983) found, however, that significant size differences occurred between adult males and females, with males measuring longer and weighing more than females.

In the Primary Study Area: No measurements of water shrews from the Housatonic River in Pittsfield, Lenox, and Lee are known to have been collected. One dead water shrew was found at the river edge in 2000, but no measurements were taken.

DISTRIBUTION

Water shrews are found in north-central and northeastern United States and adjacent Canada, extending southward in the eastern United States as a disjunct population in the Appalachian Mountains. Water shrews also occur throughout a large area of western North America largely separated from eastern North American populations (Figure 1). In Massachusetts, the water shrew is represented

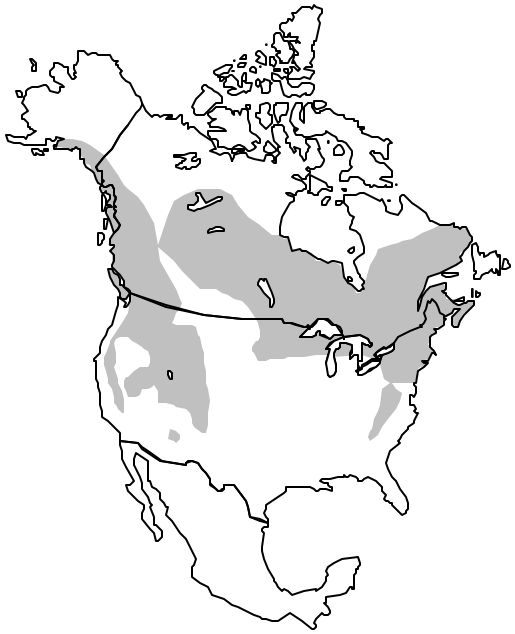

Figure 1. Range of the water shrew in North America.

by subspecies *albibarbis*, which is primarily a northeastern race found in Pennsylvania and New York, north through New England to Quebec and Labrador. Whitaker and Hamilton (1998) suggest, however, that this subspecies should be included in subspecies *palustris* due to overlap in morphological characteristics observed in Canada.

MIGRATION

Water shrews do not undergo seasonal migration, remaining in their home area year-round.

HABITAT

As its name implies, water shrews are rarely found far from water (Conaway and Pfitzer 1952, Jackson 1928, Starret *et al.* 1952). It is typically found near high-gradient streams with swift flowing water and exposed rocks, banks, and downed logs (Baker 1983, Banfield 1974, Conaway 1952). They do, however, also utilize springs, low-gradient streams, backwater sloughs, mud flats, and beaver impoundments (Wible 1946, Whitaker and Hamilton 1998). In Connecticut, water shrews have been captured along shaded streams (Wetzel and Shelar 1964). They are occasionally captured in forested settings, but then are rarely far from a body of water (Wrigley *et al.* 1979). The first record of a water shrew from Rhode Island demonstrates this fact. Although it was collected in a dry, rocky, oak-pine woodland, it was only a short distance from a temporary pond (Layne and Shoop 1971). Clark (1973) found that water shrews inhabited communities with a mean ground cover of 75 percent. This is thought to be important for maintaining high humidity near the ground, which in turn supports greater abundance of invertebrates.

Although occurring in open and forested habitats, water shrews were found to prefer stream shores with graminoid and shrub vegetation (Wrigley *et al.* 1979). Water shrews were less frequently captured in wetlands with saturated soil only, as these habitats lack the abundant invertebrate fauna associated with moving streams. Wrigley *et al.* (1979) also found water shrew observations to be positively correlated with beaver concentration, as flooded areas create open water and often grass/sedge-dominated wetlands. Water shrews were noted to utilize recently constructed and older beaver dams for foraging. Table 1 below contains a summary of the literature review and observational data on the use by water shrews of the natural community types found within the primary study area.

In the Primary Study Area: The single observation from the Housatonic River study area was from a forested shoreline south of New Lenox Road in 2000. This portion of the river is considered a low-gradient stream community, and significant stands of forested wetlands, shrub wetlands, and emergent marshes are found in this region. It is possible, however, that the individual died farther up river and floated down to where it was found.

HIBERNATION

Table 1. Habitat use by water shrew in the primary study area

Habitat Codes and Natural Community Classifications																			
Wetland Habitats												Terrestrial Habitats							
ROW	ROW & PAB	SHO		PFO				PSS	PEM		WM	VP	SW	MW	HW			OF	AGR	RES
Medium-gradient stream	Low-gradient stream	Riverine pointbar and beach	Mud flat	Red maple swamp	Black ash-red maple-tamarack calcareous seepage swamp	Transitional floodplain forest	High-terrace floodplain forest	Shrub swamp	Deep emergent marsh	Shallow emergent marsh	Wet meadow	Woodland vernal pool	Spruce-fir-northern hardwood forest	Northern hardwoods-hemlock-white pine forest	Successional northern hardwood forest	Red oak-sugar maple transitional forest	Rich mesic forest	Cultural grassland	Agricultural cropland	Residential development
Y	Y	Y	B	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			

ROW = Riverine Open Water
SHO = Shorelines
PFO = Palustrine Forested
PSS = Palustrine Scrub-Shrub
PEM = Palustrine Emergent
WM = Wet Meadow
PAB = Palustrine Aquatic Bed
VP = Vernal Pool
SW = Softwood Forests
MW = Mixed Forests
HW = Hardwood Forests
OF = Open Fields
AGR = Agricultural Croplands
RES = Residential

Season of Use
B = Breeding
M = Migration
W = Wintering
Y = Year-round
Shading = observed in study area

Water shrews do not undergo hibernation during the winter. They are active throughout the year (Sorensen 1962). Though shrews are reported to forage day and night, two periods of intense activity normally occur: after sunset and prior to sunrise. Shrews use watercourses even in winter and have been observed swimming under the ice (van Zyll de Jong 1983). Water shrews are capable of reducing metabolic demands, entering daily torpor, and nasal cooling, all of which may help them to cope with the winter season and frigid mountain streams (Beneski and Stinson 1987). Additionally, water shrews have enzymes that work well at low temperatures, and their pelage is known to trap air, resulting in a slower rate of cooling while active underwater.

HOME RANGE AND TERRITORIALITY

Little information has been collected concerning the home range of water shrews. Buckner and Ray (1968, as cited in Beneski and Stinson 1987) reported home range size of 0.5 to 0.75 acres for live-trapped individuals in Manitoba. Movement patterns indicate that water shrews move along routinely-used tracks adjacent to stream sides (Goodwin 1932). Studying this species is difficult due to low trapping success relative to other shrews (Beneski and Stinson 1987, *Yamasaki* 1997).

In a study on captive water shrews, individuals were generally solitary and interactions between either sex were usually antagonistic. Posturing, vocalization, and physical attacks were noted between shrews in enclosures. No dominance hierarchy or territoriality was evident, as outcomes of aggressive encounters did not appear to correlate with body size or location of encounter (Sorenson 1962).

Sorenson (1962) observed that captive water shrews did not appear to defend individual nests or food caches. Shrews were observed eating from caches they did not create. Water shrews occasionally defecated on food caches, and this caused some shrews to avoid the food. Water shrews were also noted to defecate in middens, so long as the population density was low, otherwise, defecation became indiscriminate. Food marking and defecating in middens were the only activities noted to be territorial in the study.

BREEDING

Female water shrews are thought to become reproductively mature in nine months (DeGraaf and *Yamasaki* 2001). However, most do not breed until after their first winter (Beneski and Stinson 1987, Whitaker and Hamilton 1998). As with other shrews, ovulation does not appear to be spontaneous, but rather is induced by copulation (Conaway 1952). Breeding season is thought to be from February to August based on indications of ovarian and testicular activity observed in wild captured individuals, which is notably earlier than most shrews (Conaway 1952). Two or three litters are produced each year, each comprised of three to ten neonates (mode of 6) (Jackson 1928). The gestation period of water shrews is unknown, but is believed to be similar to other shrews (ca. 21 days).

GROWTH AND DEVELOPMENT

Little is known about growth and development of young water shrews. The lactation period usually does not exceed seven weeks. Through examination of tooth wear, Conaway (1952) was able to classify water shrews into two distinct age classes: first year and second year individuals. He examined 61 first-year males in Montana and found that none showed evidence of reproductive activity, based on immaturity of testes and other reproductive structures. Mean body mass of first year individuals is significantly less than second year individuals of both sexes.

FOOD HABITS AND DIET

Water shrews are primarily insectivorous (Conaway 1952, Conaway and Pfitzer 1952, Sorenson 1962). A large number of invertebrates, however, are preyed on, including slugs, earthworms, spiders, leaches, and snails (Beneski and Stinson 1987). Insects commonly reported in the stomachs of water shrews include stonefly larvae (Plecoptera), mayfly larvae (Ephemoptera), caddis fly larvae (Tricoptera), tipulid larvae and other flies (Diptera), and crickets (Orthoptera).

Vertebrate prey includes salamander larvae, small fish, and dead mice. Water shrews are known to feed on fish eggs in hatchery ponds (Banfield 1974). Plant material is also included in the diet of water shrews (Clark 1973).

Water shrews are active divers, entering the water to capture prey or to elude danger (Banfield 1974, Davis 1939). The stiff bristles along the outer edge of the front and hind feet and slightly webbed toes are adaptations for aquatic mobility. They propel themselves by a walking motion of the feet (Beneski and Stinson 1987). Captive shrews are capable of sustaining dives for up to 47 seconds (Calder 1969). The stiff bristles also allow water shrews to run across the surface of calm or turbulent water by trapping small globules of air (Jackson 1928). Water shrews probe the substrate for prey with their snout while they are underwater. Due to a layer of tiny air bubbles trapped in the fur, water shrews will rise to the surface and float if they stop paddling (Banfield 1974, Svihla 1934). The pelage will saturate with water after a few minutes, at which time the water shrew returns to shore to dry by shaking and passing its hind feet rapidly over its body (Conaway 1952).

Water shrews have been observed preying on common shiners (Buckner 1970, Lampman 1947). The fish were captured by the stomach and brought to the shore. Water shrews have also been observed feeding on a larval Pacific giant salamander and a sculpin (Nussbaum and Maser 1969). In these cases, the prey was seized by the head and appeared to be immobilized.

Water shrews rely on multiple sensory systems while hunting for prey. While the functional significance of any given sense is poorly understood, some studies indicate that shrews would have difficulty catching prey relying on any one sense (Sorenson 1962). Maximum reported distance for prey detection by eyesight is about 6 inches. In some studies, however, prey were not noticed unless they were in motion, regardless of how close they were. Vibrissae and a sensitive muzzle are thought to be important for prey location, especially while underwater. Water shrews have acute hearing to distances of about 10 feet. The continuous emission of high-pitched noises while moving was suggested by Sorenson (1962) to be a form of echolocation.

Water shrews feed for short periods of time (30 to 90 seconds). Feeding periods are separated by longer intervals of time (mean 10 minutes). Water shrews are capable of eating large items by tearing off small pieces. When supplied with an abundance of insects, captive water shrews cached them one at a time in a hollow log. Cached foods were excavated and eaten within three to four weeks. Captive shrews drink water immediately after eating, sleeping, or being released from confined areas (Conaway 1952, Sorenson 1962).

POPULATIONS AND DEMOGRAPHY

Survivorship: No information was found on year-to-year or age-class survivorship for water shrews.

Age at Maturity and Life Span: Female water shrews can be reproductively active in their first year, but this represents a small proportion of individuals observed. The maximum life span is considered to be about 18 months (Conaway 1952).

Mortality: Factors contributing to water shrew mortality include predation and parasitism. Due to their small size and their use of aquatic habitat, they are preyed on by many predators that inhabit river and stream systems, including mammals, herpetiles, birds, and fish (Beneski and Stinson 1987). Water shrews have a large number of endo- and ectoparasites that are largely unique to their species (Beneski and Stinson 1987).

Enemies: Weasels and mink do occur in similar communities as water shrews and are known to prey on them. Garter snakes, water snakes, and possibly large frogs are herpetile enemies. Hawks and owls prey on many small mammals, including water shrews. Brown trout, brook trout, rainbow trout, black bass, pickerel, and walleye are fish predators (Grierson 1948, Jackson 1961, Linzey and Linzey 1973, Marshall 1951, Wetzal and Shelar 1964).

Ectoparasites reported for water shrew includes several species of mites, chiggers, fleas, and ticks. In New Brunswick, a hypopial mite (*Glycyphagus hypudaei*), a myobiid mite (*Protomyobia claparedei*), and a chigger (*Miyatrombicula esoensis*) were the most abundant ectoparasites on water shrews (Whitaker and French 1982). Documented endoparasites include two groups of organisms: nematodes and cestodes. Two species of subcutaneous nematodes, one from the stomach and one from the bladder, parasitize water shrews. Known species of cestodes inhabit the duodenum and coelomic cavity of the water shrew (Beneski and Stinson 1987).

STATUS

General: Water shrews are considered to be present throughout much of New England but uncommon in any given area (DeGraaf and *Yamasaki* 2001). Low trapping success relative to other shrews suggests that this species is uncommon. Whitaker and Hamilton (1998), however, assert that the water shrew is more common than museum specimens would indicate. Water shrews are difficult to observe due to their habit and habitat and are likely under reported.

In The Primary Study Area: Only one water shrew was observed in the primary study area. This was a dead specimen found on the bank of the Housatonic River, the cause of death unknown. Thousands of trap-nights were recorded for the study area within appropriate communities utilizing snap traps and pit traps, methods that are known to successfully capture water shrews. No captures, however, were recorded. Figure 2 provides the approximate location of the observed water shrew carcass in the primary study area.

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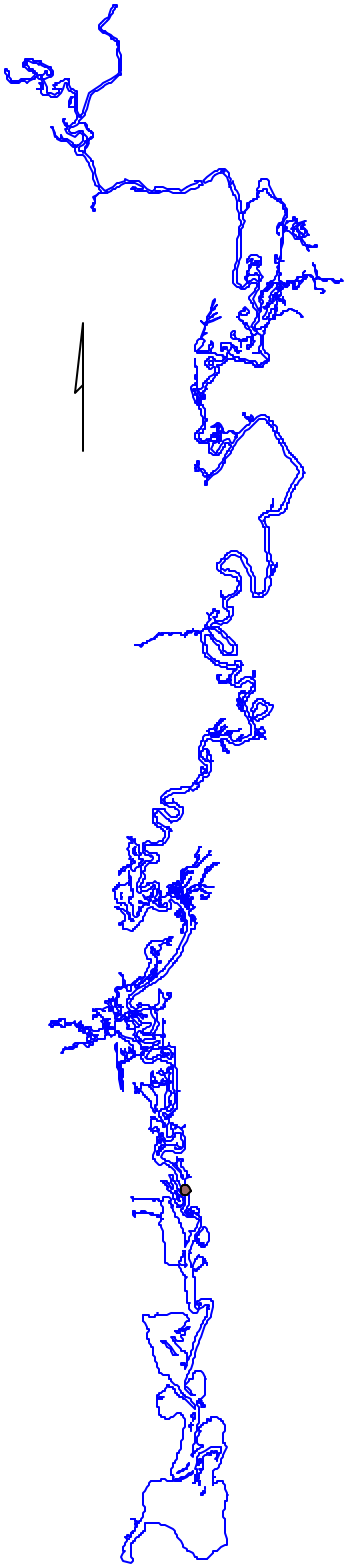

Figure 2. Single water shrew sighting in the primary study area (2000)

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